an enigma. Discouraged by failure after failure, and having about abandoned all further effort to open up the interrupted communications, all hands were astonished when suddenly the signals began to come in again, clear and distinct. An attempt has been made to explain this phenomenon by the difference in the velocity of the electric rays when traveling over the land or over the water. Like Marconi and Lieut. Solari, we too are loath to accept this explanation.

In the roads at Kiel on July 24 many dispatches were clearly received on the Morse. Previous care having been taken to guard against the danger, messages were successfully and satisfactorily received during the raging of a violent storm. Experiments were made with Castelli's carbon and mercury coherer, concerning which so much comment has appeared in the technical press of England, Germany and America. It would seem, however, that these experiments were not satisfying. For several days thereafter excellent and uninterrupted communication was enjoyed with the station at Cape Lizard as well as with the other Marconi stations on the eastern coast of England. August 2 saw the "Carlo Alberto" anchored in the harbor of Plymouth. The twenty days ensuing were occupied with the necessary preparations for the radiotelegraphic campaign then to be undertaken in the Mediterranean. For this purpose the receiving antennæ were somewhat modified, being composed of 50 conductors placed at an elevation of 50 meters (about 160 feet) above the bridge. Everything being in readiness, on the 25th of August Marconi boarded the "Carlo Alberto" at Mullion and set sail for Ferrol, Spain. Both during the voyage and while in the port of Ferrol messages were received without serious interruption. Ferrol was left on the 30th of same month for Cadiz. During the course of this voyage it was possible to ascertain that the maximum distance over which a communication could surely be made, by day, with the power then available, viz., 40 horse power, and the sensibility of the receiver the greatest possible (discounting the atmospheric-electric perturbations) was about 1,000 kilometers. On the night of the 30th and 31st of August the effect of the interposition of the Spanish mainland was observed. In spite of this, the receiving coherer continued to work well, and all the news received by the wireless system was communicated to the officers and crew, who were much delighted thereby. During the night of the 3rd and 4th of September, the "Carlo Alberto" entered the deepest inlet in the roads of Gibraltar, where, in spite of the 1,500 kilometers of distance and the obstructions offered by the most rugged of land formations, several dispatches were received from Poldhu (Cape Lizard), among others the one relating to the health of the Czarina.

At this point in the official report there is a vague passage, which does not say with positiveness whether certain dispatches originating in England were received at Cagliari or at Spezzia. The report continues: "The successive days of the 4th, 5th, and 6th of September saw a new triumph for the imposing invention of Marconi most certainly demonstrated, viz.; the fact that from the beginning to the end no obstacle interfered with the satisfactory working of his system of radiotelegraphy, while conducting experiments in a closed sea, a sea closed by such extensive mountain ranges as the Mediterranean, and that the radio-telegrams arrived from Poldhu constantly and surely at the receiver on board the "Carlo Alberto." As proof of this we have the Morse ribbons regularly signed by Rear Admiral Mirabello, who thus personally attests the truth of these experiments."

We give below the conclusions drawn from the experiments by Marquis Solari:

1. To begin with, there is no limit to the distance which may be covered by the electric waves on the surface of the globe, if the energy employed in the transmission is proportionate to the distance to be traversed.

2. Dry land interposing between a transmitting and a receiving station does not interrupt the communication.

3. Solar light diminishes the radius of action of the electric waves, and an increase of energy, for the transmission during the day, over that necessary for night work is therefore required; the obstructive influence of atmospheric electrical discharges also compels the use of less sensitive receivers, if they are not to be affected, and a corresponding increase in the energy of the transmitters.

4. The magnetic detector has by these experiments shown itself far superior to every coherer, because it needs no regulating; because of its absolute constancy in operation as well as for its practicability and the extreme sensitiveness of the system.

5. The Marconi Wireless Telegraphy has by virtue of these latter improvements entered upon the field of the grandest of the applied sciences, either commercially or for military purposes, without limit of distance.

Several objections thrust themselves upon the mind on reading these sweeping conclusions of Lieut. Solari, conclusions which, we fear, derive no small amount of enthusiasm, justifiable enthusiasm for that matter, from the part that the valiant officer himself took in the experiments. We are only too willing to heartily agree with all the above conclusions, although upon the item of distance we are inclined to the transmission by intermediate relay stations; moreover we feel that, the mere fact that a communication may have been held between two persons, one on the coast, the other 1,000 or 2,000 kilometers at sea, does not prove that a like communication would be possible with the same expenditure of energy, the same antennæ and the same apparatus over a distance of 500 kilometers on the land. To the support of this doubting we desire to bring but one of many arguments: If the sea has an acknowledged directing influence over the electric waves, how is it possible to affirm that one may hold wireless intercourse over land without regard to distance? The electric waves may follow the sea or traverse the contours of continents, but that does not say that the transmission of a signal is equally as easy and possible over similar distances between two stations situated in the interior as if they were upon the sea. Concerning the dis-electritation of the transmitting antennæ, said to be due to the sun's rays or solar light, it appears to us that this difficulty might be readily overcome by covering the transmitter with an opaque body. It has several times been upon our minds to remark that certain insulating materials as caoutchouc and the like which surround the antennæ produce a diminution in the effects due certainly to absorption. (Note the experiments on the Righi.) As for the *magnetic detector*, the most explicit description and explanation is to be desired. We voluntarily admit that this instrument is surer than the coherer, which is not a very difficult matter, but is it more sensitive also? Can one conceive how little energy is needed to actuate coherers, as sensitive as those of Blondel for example? That the commercial future of wireless telegraphy is assured is indisputable; it is also indisputable, we think, that wireless telegraphy itself is discussed.

THE GENESIS OF COAL.

THE popular view of the formation of coal may, perhaps, be summarized as follows: Certain plants or trees grow in morasses; they decay and sink; more plants grow on the first layer, and sink in their turn. The weighted-down residue decompose through the influence of microbes, with the generation of methane and carbonic acid; and when the decomposed mass is afterward exposed to high pressure, we find, according to the age of the deposit, peat, lignite, coal, or anthracite—graphite does not appear to have the same genesis as coal. Some weak points of the popular view are pretty apparent. If time and pressure be the main factors which decide the character of the coal, then we should find anthracite in the oldest geological formations, and peat in the most recent. But lignite occurs in the Devonian, and we know historically of the change of mine timber into lignite, while we have no examples of peat passing into coal. Further, anthracite forming the bottom layer should contain most ashes, and, so far as actual experiments can teach us, the very highest pressures of 20,000 atmospheres do not cause vegetable fiber to become coal.

Dr. J. F. Hoffmann, of Berlin, who discusses this question in the Zeitschrift für Angewandte Chemie, raises some other points. He would distinguish three periods in the formation of coal. First, a period of microbe activity, a fermentation, so to say, then a period of decay, and finally the carbonization period proper. The microbe period cannot have extended into the subsequent stages, for most coals are comparatively dry, so that microbes could not have had access, nor lived in them, and the aromatic compounds which coal contains are, moreover, poisonous for microbes. There is probably no uncombined carbon as such present in our coal, according to F. Muck. The chlorophyl of the green plant has the power, we believe, to split the carbon dioxide which the plant inhales through its pores, in the sunlight, into carbon and oxygen, and this nascent carbon combines with water to form carbo-hydrates which build up the plant. These carbo-hydrates are not decomposed in their turn, but they polymerize, and the albuminoids which are also formed likewise. High pressure, time, long-continued access of oxygen, fermentation, and decay do not yield us carbon and water as final products as long as we keep to ordinary temperatures.

The case is different—and this is Hoffmann's chief point, argued out in a novel way—when we presume that the temperatures have fluctuated considerably. Mere heat does not change wood into coal, though we can finally obtain a substance like anthracite when we gradually raise the temperature above 400 deg. Cent. Hoffmann draws attention to the spontaneous heating and ignition often observed in vegetable products, and he studies the problem thermo-chemically. When carbohydrates are subjected to dry distillation, they split into carbon and water, the more completely the lower the temperature is kept. The water reacts again on the carbon *in statu nascendi*, and there result unsaturated compounds, such as we meet in coal. This combination takes place with absorption of heat, and is comparatively quick, so that we need not assume periods of thousands of years for this second period. During the first stage heat is given off, and the temperature may rise to 670 deg. Cent. in the case of carbohydrates under decomposition. Albuminoids behave similarly. With them, in fact, spontaneous ignition is very common in a certain sense. While, for instance starch does not heat spontaneously, germinating grain becomes very hot in the presence of albuminoids.

We will not inquire into the mutual relations between plant life, microbe life, and albuminoid food for the germ and for the microbe, which problem Dr. Hoffmann leaves untouched; but we will pass to authenticated cases of spontaneous ignition. Hay is very apt to heat in warm, damp condition, and to burst into flames when air gains access. Bran is not so easily inflamed; but Hoffmann had to investigate a case which set him thinking. The organized remnants of plants, such as hay and bran, he says, continue to breathe, and when they find no free oxygen—the live plant inhales carbon dioxide, though—they feed on the intermolecular oxygen, as the yeast fungus does in alcoholic fermentation. Wet flax is notoriously dangerous, and so are oiled rags. A mill containing grain and flour was burned down in Berlin some years ago; the fire was ascribed to spontaneous combustion, and in some big lumps of smoldering grain which had been thrown into the river Hoffmann discovered layers resembling lignite, coal, and anthracite in their sequence. In all these cases moisture favors the combustion or the fungus growth starting it, because there is a breathing process. With coal this is not so, because there is no organized fire and no breathing—or no fungus growth, we prefer to say. Geologically, we have reason to believe that the formation of the coal-beds was followed by violent tectonic convulsions, during which heat and pressure may have co-acted. If we start with a deposit of peat, most of the water would be squeezed out during these convulsions; but enough would remain for chemical reactions. By spontaneous combustion some seam would become charred; the heat would be communicated to another seam and so on, so that coal-beds of considerable extent would be produced. But Hoffmann himself sees that we do not understand, on these lines, how it is that coal-beds consist of fairly uniform coal—coal, anyhow, not lignite—all through down to their extreme veins. We do not arrive at any final conclusion as to the genesis of coal, therefore, and the chief interest of Dr. Hoffmann's paper lies in the fact that he draws attention to the influence of spontaneous combustion. The standpoint which geologists maintain toward this "growth in place" theory was very well expressed by Mr. Aubrey Strahan, in a paper which he presented to the Geological Society last year.—Engineering.

STARS BY DAYLIGHT.

ARE the stars visible to ordinary sight in the daytime? asks Mr. E. Walter Maunder in Knowledge. There is a widespread tradition that they are; that if an observer placed himself at the bottom of any deep shaft—as of a mine, a well, or a factory chimney—which may shut off scattered light and reduce the area of sky illumination acting on the retina, he will be able to discern the brighter stars without difficulty. The tradition is one of a respectable antiquity, for Aristotle refers to persons seeing stars in daylight when looking out from caverns or subterranean reservoirs, and Pliny ascribes to deep wells a similar power of rendering visible the stars the light of which would otherwise be lost in the overpowering splendor of the solar rays. The tradition, well founded or not, has often been adopted for literary effect. It seems almost sacrilegious to hint that no star known to astronomers could have shone down unceasingly upon poor Stephen Blackpool during his seven days and nights of agony at the bottom of the Old Hell Shaft; that at best he could only have caught a glimpse of it for a few minutes in each twenty-four hours as it passed across the zenith. Dickens indeed does not absolutely say that Stephen watched the star by daylight; it is only a natural inference from his description. But is the tradition true? Of course everyone knows that Venus from time to time may be seen even at high noon; but then Venus at her brightest is many times over brighter than Sirius. Then, again, the assistance of a telescope enables the brighter stars to be discerned at midday; but the telescope not only directs the eye and greatly limits the area from which the skylight reaches the observer, but it enormously increases the brightness of the star relative to that sky illumination. The naked eye observation of true stars in full sunlight stands in quite a different category. Humboldt, who was much interested in the question, repeatedly tried the experiment in mines, both in Siberia and in America, and not only failed himself ever to detect a star, but never came across anyone who had succeeded. Much more recently an American astronomer set up a tube for the express purpose of seeing the Pleiades by daylight, also with no effect. It has been supposed that Flamsteed, the first Astronomer Royal, sank a well at Greenwich Observatory for the purpose of observing Gamma Draconis, the zenith star of Greenwich, in this manner. The existence of the well is undoubted though Sir George Airy, the late Astronomer Royal, was unable to find it, but Flamsteed marks it on more than one of his plans of the Observatory, and there is a drawing extant of the well itself, showing the spiral staircase that ran down it. But its purpose seems to have been, not to have furnished the means of observing the star with the naked eye, but to enable the observer to measure as accurately as possible the distance of the star from the true zenith at the moment of transit.

COTTON GROWING IN CUBA.

ACCORDING to the New York Tribune, the subject of cotton raising in Cuba has become of widespread interest here, and it has been generally recognized as of the greatest importance to the island in view of the present low price which is commanded by the two principal products of the island, namely, sugar and tobacco. The extremely small returns from these two products, which the Cubans had come to believe were the only things that could be grown on their fertile land, have caused them to seek other ways of gaining a livelihood, and one way has been found in cotton raising.

Now that this product has come under a careful study the people who are investigating its possibilities are astonished at the promise which is held forth. The Sea Island variety can be grown here better, and in almost double the quantity to the acre, than in any other place of which there is any record. It seems incredible, but, to begin with, it can be safely stated that on a farm of a caballeria (thirty-three and one-third acres) the sum of $3,021.65 clear profit can be made over and above all expenses. These figures are not theoretical, but have been proved by experiment. Sea Island cotton's minimum production in Cuba is 1,500 pounds of seed cotton to the acre, and the maximum is 2,000 pounds, and the latter is not at all infrequent. A caballeria, then, calculating at the minimum production, will produce 50,000 pounds of seed cotton. This seed cotton will give one-fourth of its weight in lint cotton, or 12,500 pounds. At the latest report from Liverpool this cotton brought 27 cents a pound, which would mean $3,375.

Out of the $3,375 for which the cotton can be sold in Liverpool the cost of production of the cotton must be deducted. The price of land and all will be included in this estimate. One caballeria will cost the small sum of $333. In the South one plow hand and one hoe hand are employed to cultivate forty acres. In Cuba one plow hand and two hoe hands will be needed. These people for six months will cost the farmer, including wages and rations, $300. The seed to plant the caballeria will cost $23.35. To pick the cotton will cost $30, and, estimating that the seed will pay for the ginning, which it will more than do, the total cost of cultivation, picking, etc., amounts to $353.35. Deduct this amount from the previous figures and there remains the net profit of $3.021.65.

The reason for this immense profit in Cuban cotton is that Cuba produces more cotton to the acre, and of a longer staple, than that produced in any other part of the world. Cuban cotton is a full three and a half inch staple and upward, and, according to good authority, no other country has produced a three-inch

TURBINE INTERRUPTER FOR ELECTRIC CURRENTS.

AFTER finding that interrupters with metallic contacts were incapable of actuating large induction coils, Foucault devised the mercury interrupter that bears his name. An endeavor is now making to utilize currents of a higher difference of potential, such as those furnished by the electric sectors of Paris, for which the Foucault interrupter is itself inadequate. It has therefore become necessary to return to interrupters with contacts of metal upon metal. But many of these apparatus are defective in that they become heated, and are irregular and incapable of operating for a sufficient length of time.

After many experiments, MM. Lecarme and Michel have succeeded in constructing an interrupter that gives satisfaction in every respect and the operation of which approaches perfection (Fig. 1).

This apparatus is arranged like a centrifugal turbine, with the difference that the paddles are provided with flexible metal prolongations, *p p'* (Fig. 2), so that, during the revolution, those of the movable part, *p*, come into contact with the stationary one, *p'*. Through this arrangement the prolongations that are revolving strike with force those that are at rest, and during the period of each contact, the pressure of the stationary contacts upon the movable ones increases until it becomes maximum at the moment of the breaking of the current. The result is that the intensity of the latter increases during the entire duration of the contact, and then becomes abruptly null. At this moment, the insulating liquid, carried along by the revolution of the system, as in a centrifugal pump, blows out the spark and at the same time cools the contacts. This motion of the liquid, which is continuously renewed toward the edge of the arms, keeps the contacts in a perfect state of cleanliness and thus prevents their oxidation.

The arrangement indicated in Fig. 2 comprises: (1) A stationary part formed of a metal cylinder, *a*, that carries upon its internal surface a certain number of contacts, *c*, *c*, and that is filled with an insulating liquid; (2) a movable part formed of an axis, *b* arranged in a line with the cylinder and carrying a piece of bronze, *t*. This piece, which is in the form of a turbine, is provided with as many arms as the cylinder is furnished with stationary contacts (four in the figure). When a rotary motion is given to the axis, *b*, all the movable contacts, *p p*, come simultaneously opposite the stationary ones, *p' p'*.

The cylinder, *a*, and the axis, *b* (perfectly insulated from each other), are interposed in the circuit of the current to be interrupted; and the current is established every time the movable contacts touch the stationary ones.

It will be seen from this arrangement that it is possible to cause the passage of a current of very great intensity by multiplying the number of the arms and increasing their length and, consequently, their surface of contact. The breakage spark is thus dispersed and equally distributed at the rate, say, of 1 ampere per 4-10 inch of length of contact. All heating is therefore prevented.

On another hand, when the rotary velocity becomes very great, and gives rise to very frequent interruptions, instead of the mean intensity of the current diminishing as in other interrupters, the centrifugal force tends to throw the movable contacts outwardly, and consequently to increase their pressure upon the stationary ones. The intensity then remains sensibly constant, whatever be the velocity. Thus, a large coil, actuated by this interrupter and a current of 110 volts, gives a jet of sparks between the terminals for 10 interruptions per second, as well as for 200. It must be noted, however, that if a constant capacity be preserved in the condenser of the coil, the intensity of the current will vary slightly with the velocity. With variable condensers it is possible to keep it perfectly constant.

The following are the results obtained, after numerous experiments, with an apparatus of four arms 2 inches in length. The current furnished by a dynamo of 120 volts traversing a coil giving a 3-foot spark was of a mean intensity of 20 amperes. After an hour's operation the temperature was 35 degrees. The same apparatus has even been operated with a current of 40 amperes, without any appreciable wear being exhibited by the contacts. A large apparatus of Tesla's, actuated by the same coil, gave rise to a multitude of discharge sparks that made so loud a noise that it was impossible for a person to hear his own voice, even at the other end of the laboratory, or to perceive the noise of the machines. We think that these experiments permit of the hope that wireless telegraphy may derive profit from this apparatus, and that, through the use thereof, it will be possible to increase the range of the signals to be transmitted.—Translated for the SCIENTIFIC AMERICAN SUPPLEMENT from La Nature.

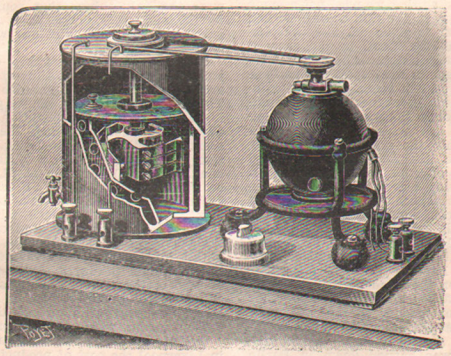

FIG. 1.—TURBINE INTERRUPTER (GENERAL VIEW).

MARCONI'S "CARLO ALBERTO" EXPERIMENTS.*

By EMILE GUARINI, Brussels, Belgium.

THE daily papers and technical journals all over the world have published the results of Marconi's recent experiments on board the ship "Carlo Alberto," results obtained at first during his voyage to Cronstadt and afterward in the Mediterranean, during which he communicated with the transmitting station at Cape Lizard over the extraordinary distance of 1,600 miles

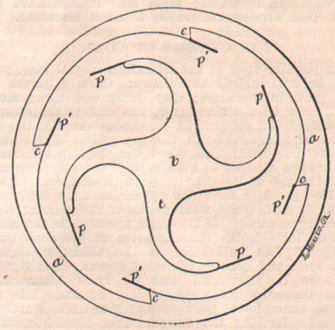

FIG. 2.—PLAN VIEW OF THE INTERRUPTER.

(French) of which a great portion was over dry land. There are many who are still incredulous, not so much because of the seeming impossibility of such a feat, but rather on account of the contradictory and exaggerated reports furnished by the papers, which at the same time attributed to Marconi conversations and plans in which the illustrious inventor perhaps never indulged. In this manner much was made of the *absolute secrecy* of the communications resulting from his new system of attuning the receivers; also of the possibility of sending messages across Switzerland and the Alps; one journal even maintained that Marconi could without difficulty transmit his messages overland without regard to distance. It may be noted in passing, that, theoretically considered, messages are possible from any given point to any desired point upon the earth's surface, and provided sufficient impulse can be given to the electric waves, it is indeed practicable to send them through the earth itself. Archimedes once said: "Give me a fulcrum and a lever long enough and I will lift the earth." The problem to solve in this particular is whether or not such communications are practical, that is, whether the extreme cost of operating stations producing such high electric energy would not exceed the commercial revenue.

Demonstration has proven that it requires 40 horse power to communicate easily, during the day, with a station 1,000 kilometers distant. To send, therefore, a message 20,000 kilometers (about half around the globe, the complete tour not being necessary) and admitting that the energy required varies as the square of the distance a force of $20^2 \times 40 = 16{,}000$ horse power would be needed. This entails a by no means insignificant plant. Would not a line of intermediate automatic stations be even more economical? In this latter case the energy would increase instead of diminishing with the distance. Doubtless the general public will be glad to receive positive and reliable information concerning Marconi's above mentioned experiments and we cannot do better than give here a résumé of the official report made to the Italian Naval Department by Marquis Solari, who besides being the lieutenant commander of the vessel and a co-worker with Marconi in these trials, is a distinguished officer of whose valor and capabilities we have had personal demonstration.

Last June the ship "Carlo Alberto" of the Royal Italian Navy returned to England equipped with one of Marconi's old-style radiotelegraphic outfits, which had already withstood several journeys by rail and been several times shipped and transshipped without any special care. On this account the installation and regulating of the apparatus consumed several days' time and required much patience and care. Being thus supplied, the "Carlo Alberto," as soon as she arrived in English waters, placed herself in radiotelegraphic communication with the station at the Lizard in Cornwall where Marconi himself was, and with his aid at once took the necessary steps to set up a more sensitive and perfect appliance. On the 26th of October, Marconi came aboard bringing with him instead of the usual coherer, a magnetic detector. A supplementary mast about 50 feet high was erected in the forward part of the ship. Between this and the ship's foremast was suspended the antennæ carrying four cables, the antennæ being inclined in such a manner as to form a certain angle, and reflect, so to speak, directly into the operator's hut on the deck.

The points of suspension of this combination of spreaders and cables were insulated by chains of porcelain, and the cable entrance to the operating room was through an ebonite tube of suitable length and diameter. Every possible precaution was taken to insure perfect grounding; cables were attached to several parts of the machines as well as to the keel of the ship. An extra powerful transmitting station would require an especial outfit of implements which would be very cumbersome not to say expensive; accordingly the "Carlo Alberto" was only fitted out as a receiving station for wireless messages. Two ordinary coherer receivers furnished with transformers attuned to the station at Cape Lizard and three magnetic detectors were installed. The coherers were as usual connected with the Morse receivers while the magnetic detectors actuated the telephones.

The station receiver on board the "Carlo Alberto" was the same with which Marconi, in February last accomplished such remarkable feats on the "Philadelphia."

The transmitting antennæ at the Lizard resembled those which Marconi had installed at Cape Breton. Four wooden masts about 220 feet high were erected at the corners of a quadrilateral whose sides measured about 190 feet. The tops of the masts were connected by heavy steel cables, from which hung 400 copper conductors, 100 on each side of the quadrilateral, and placed a trifle less than two feet apart. All these conductors are united into one cable at about 13 feet from the ground before they enter the operating room. This construction presents the appearance of an inverted pyramid. The potential with which the aerial conductors were charged during the transmission, was such that sparks of 0.30c. could be obtained between their summit and a conductor placed on the ground. This is an enormous potential if one takes into consideration the stupendous power necessary to charge them.

Marconi himself arranged for all the experiments, fixed the hours of work both by day and by night, and determined upon the signals to be sent; he then embarked at Dover on the "Carlo Alberto" on July 7. At a distance of 500 French miles from the Lizard, and of which six-tenths of the flight was over dry land, the experiments began. No sooner had the attuning been effected to a certain point than the telephones connected with the magnetic detector gave forth the first sounds to come from Cornwall. "Because of the imperfect attuning," said the Marquis, "the first sounds from the telephones were feeble and indistinct, and also because of the anti-electrical effects of the sun's rays or solar light." On the following day messages were received with fewer obstructions and the coherers actuated the Morse receivers sufficiently to obtain a register or copy of the messages. The sending of messages from Cape Lizard being now suspended for the day, the "Carlo Alberto" became a transmitting as well as a receiving station and as such entered into communication with the English Marconi telegraph stations at North Foreland, Trinton, etc., through the courtesy of which he sent several dispatches to different points in Europe, notably one to the Italian Minister of Marine at Rome. During the night of July 7, and owing to the more favorable influence of darkness, the "Carlo Alberto" received additional signals from the Lizard now 900 kilometers away, both on the coherer receiver and on the receiver connected with the magnetic detector. During a trial, at a distance of 1,000 kilometers from the Lizard, which was made at noon of July 9, the coherer failed to catch any of the signals while the magnetic detector caught the rhythmic sounds of several SS. The following night and during the nights of the 11th and 12th of July, at first dispatches and then signals were received by Marconi at Cronstadt across the Scandinavian peninsula. At Cronstadt the signals (SS) were indistinct, because, it is said, fresh water makes a poor grounder. On July 23, the "Carlo Alberto" steamed for Kiel, and just at this time the reception of the signals had been much improved, either by effecting a more perfect attuning of the instruments or by increasing to 50 the number of the conductors suspended from the receiving antennæ. Thanks to these artifices several SS were distinctly received from Cornwall. On the return voyage the facility of receiving was improved still more, but a series of inexplicable phenomena occurred, the most notable of which was the sudden and total cessation of all signals. At 1 o'clock, on July 23, the "Carlo Alberto" being then in the Baltic, received very distinctly several signals from Cape Lizard, over 2,000 kilometers away. At 2 o'clock atmospheric disturbances interfered with the working of the coherer to such a degree as to render it useless for the time being, while the precautionary measures which had been taken prevented any interference with the working of the magnetic detector. An incomprehensible phenomenon now took place. At first the receiving became somewhat imperfect and at length it became impossible to get any response whatever. In vain were made all possible attempts to ameliorate the conditions, all efforts at receiving and attuning; in vain were the antennæ of the "Carlo Alberto" placed parallel with those at Cape Lizard by causing the ship to take up the proper position. The failure of this last resort proved that even for Marconi the manner in which the electrical waves or impulses proceed is still

* Specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT.